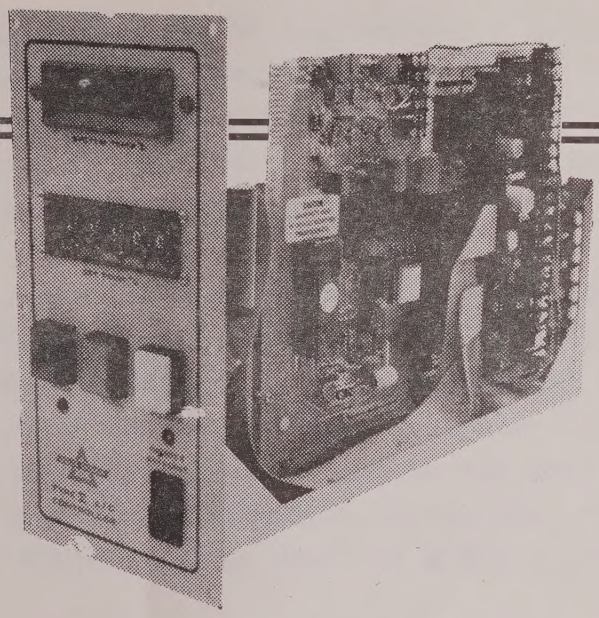
A 1570

INSTRUCTION MANUAL

Model A1570



DELTA DESIGN INC.

TYPE V CONTROLLER

(Microcomputer Based)

ENVIRONMENTAL CONTROL EQUIPMENT FOR RESEARCH AND INDUSTRY

5725 KEARNY VILLA ROAD • SAN DIEGO, CALIFORNIA 92123

V-0484

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SPECIFICATIONS

TEMPERATURE RANGE	$-73^{o}C$ to $+315^{o}C$ or $-73^{o}C$ to $+175^{o}C$ (Selectable with a jumper wire added) (Controller provides automatic shut-down if setpoint goes out of limits-display will indicate ----)
RESOLUTION	$0.1^{o}C$ (Digital Display and Setpoint)
CONTROLLER ACCURACY	$\pm 0.1^{o}C$
REPEATABILITY	$\pm 0.1^{o}C$
SENSOR	Type J thermocouple (iron-constantan)
COLD JUNCTION COMPENSATION	Built in; compensation error $< .01^{o}C/^{o}C$ ambient
SENSOR LINEARIZATION	23 Segment, digital, no calibration required
SHORT TERM STABILITY	$\pm 0.1^{o}C$
DEADBAND	$0.1^{o}C$
LINE VOLTAGE COMPLIANCE	$.001^{o}C$/volt RMS
CONTROL MODE	PID (Proportional/Integral/Derivative) Control, time proportioning with zero-voltage-switching, automatic heat or cool. PID function is "self-adaptive", i.e. the control function automatically adjusts itself for optimum chamber performance
HEAT OR COOL PROPORTIONAL BAND WIDTH	$6.4^{o}C$
DISPLAY UPDATE RATE	7.5 readings/sec.
TIME PROPORTIONING PERIOD	1 second
CALIBRATION PROCEDURE**	Two steps, no iterations 1. Ambient* 2. (Full scale) Slope

CONTROLLER OUTPUTS	Heat (zero crossover controlled solid state switch, 15 amp) Cool (SSR, 129V, 1 amp max.) "Error Nulled" (Contact closure, 200V peak, 0.5 amp non-inductive load)
ADDITIONAL FEATURES	Open thermocouple protection automatic shutdown (display will read "P. OP.")
	Remote setpoint input (parallel BCD)
	Remote temperature output (parallel BCD)
	"Null" contact closure output (temperature within $\pm 1.6^{o}C$ of setpoint). Contact rated at 0.5 amp non-inductive.
CONTROLS	POWER ON-OFF Switch/indicator light COOL ON-OFF Switch/indicator light HEAT ON-OFF Switch/indicator light Temperature SETPOINT Control REMOTE SETPOINT Control Switch and indicator
VOLTAGE REQUIREMENTS (Derived from temperature chamber or handler)	120 VAC, 50/60 Hz, Single Phase
NET WEIGHT (approx.)	4 Lbs. (1.81 Kg)

* Unless otherwise specified:
Ambient temperature = $25^{o}C \pm 10^{o}C$
Line voltage = 115 VAC $\pm$ 10%

** This procedure calibrates the controller display and control simultaneously.

CONTROLLER MODEL NUMBERS

120V	208-240V	208-240V for 7650	Temperature Range	Front Panel
A1570-1	A1570-3	——	-73°C to +175°C	Vertical
——	——	A1570-4	-73°C to +175°C	Horizontal

NOTE: IT IS RECOMMENDED THAT THIS MANUAL BE READ THOROUGHLY BEFORE CONNECTING EQUIPMENT TO ELECTRICAL POWER SOURCE.

INTRODUCTION

The Delta Design, Inc., Type V Controller has been specifically designed for use with Delta Environmental Test Chambers, Burn-In Chambers and Environmental Handlers, but is adaptable for use with any System which can utilize a type J (iron constantan) thermocouple as a sensor.

The Type V Controller is a high precision, microcomputer based Controller which utilizes digital techniques to provide control action for the temperature system. The Controller has the capability to change its control parameters automatically, thereby allowing the controlling action to adapt to a particular chamber and its unique thermal response characteristics. Utilizing these principles, the Controller's microcomputer automatically performs the regulation of both heat and/or coolant of the temperature system. This is accomplished by providing separate output time proportioning commands. The Type V Controller also provides built-in cold junction compensation and open thermocouple protection. The digital display located on the control panel indicates actual system temperature with a resolution of 0.1^{o}C. The display also will provide feedback if the thermocouple sensor is open by displaying "P.OP.". If an improper setpoint is entered on the digital thumbwheel switches or the remote setpoint switch is activated without proper interface, the display will indicate "----". When the display indicates either "P.OP." or "----", heater power and/or coolant are disabled.

The Controller features built-in interface capability for remote or external temperature control setpoint selection as well as external programming.

Standard interface capabilities are: 16 lines I/O plus two handshake lines. The I/O lines may be steady state (BCD), latched input or computer interface. Optional interface capability is with the IEEE 488 Bus. This allows the Type V Controller to be directly tied into a computer controlled instrumentation system.

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1 PRINCIPLE OF OPERATION

1.1 Description

1.1.1 The Controller utilizes a type J (iron-constantan) thermocouple as a sensor in the temperature control system. The output of this sensor is amplified by a differential DC solid state feedback amplifier and is applied to the input of a 12 bit dual slope A/D (analog to digital) converter (the A/D converter incorporates automatic zero drift compensation and has a conversion rate of 7½ conversions per second). The converted sensor output signal can then be processed by the microcomputer in the temperature controller.

1.1.2 The microcomputer compares this system feedback signal to the setpoint as selected on the digital thumbwheel switches. The Controller, through the microcomputer, will regulate heat and/or coolant to maintain the set temperature, resulting in minimum coolant and power consumption.

1.1.3 The microcomputer determines error by numerically subtracting the system temperature from the setpoint. It performs other numerical operations as well, including integral feedback, rate feedback and the generation of time proportioning outputs to control the heat and cool drivers. It also provides a linear correction of the nonlinearities associated with the thermocouple. All of these operations done numerically eliminate linearization adjustments, rate adjustments and integration adjustments required to match the requirements of a particular system.

1.1.4 The Controller incorporates adaptive feedback control and measures the response of the thermal system it is controlling when the system is heating or cooling outside of the heat or cool proportional band (6.4^{o}C). The controller uses this measured response to automatically adjust the variables in the temperature control algorithm so as to enhance the setting characteristics of the total system. This adaptive capability alleviates the need for adjustments other than the initial ambient temperature reading calibration and full scale calibration.

WARNING

Ensure that all sources of power have been removed from the equipment prior to installing, removing or servicing the Controller.

CAUTION

Some components used on the Controller P.C. board are static charge sensitive. Unnecessary handling should be avoided. Removal of components from this board will VOID the Controller warranty.

2.1 Electrical Connection

2.1.1 Electrical connection is made between the Controller and the Chamber or Handler at TB1 and TB2 on the rear of the Controller. For terminal designations see D1656973 or D1656974.

2.1.2 When the Controller and the Chamber or Handler are purchased as a unit, the Controller will be installed in the unit and calibrated prior to shipment.

3 STARTING UP PROCEDURE

3.1 Controls

3.1.1 POWER Switch/Indicator Light - ON position - main power to the unit is ON. The white light is illuminated when power is ON.

3.1.2 COOL Switch/Indicator Light - ON position allows the Controller to apply coolant automatically to reach and maintain selected temperature in the test chamber. The blue light is steadily illuminated while the chamber is cooling. The light blinks when the chamber reaches selected temperature below ambient.

3.1.3 HEAT Switch/Indicator Light - ON position allows the Controller to apply heat automatically to reach and maintain selected temperature in the test chamber. The red light is steadily illuminated while the chamber is heating. The light blinks when the chamber reaches selected temperature above ambient.

3.1.4 Digital SETPOINT Switches - Chamber operating temperature is set by dialing the desired temperature into the five thumbwheel switches. The temperature setting capability ranges from -73°C to +315°C (or optional -73°C to +175°C).

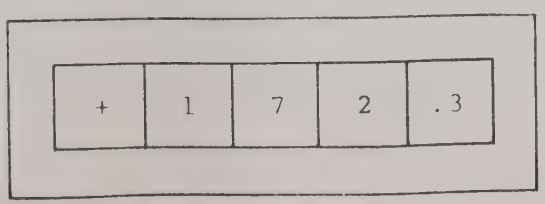
3.1.5 REMOTE SETPOINT Switch and Indicator - The temperature setpoint is normally obtained by setting a thumbwheel switch on the front panel. By actuating the REMOTE SETPOINT switch (LED illuminated), the Controller microcomputer will look at the information present at the "program socket." The program socket is a 25 pin "D" subminiature connector on which lines 1 through 16 are the 4 decades of BCD representing the digital setpoint. If there is no connection at the program socket, the Controller digital display will indicate (----) and heater power and/or coolant will be disabled.

3.2 Setting the Thumbwheel Switches

3.2.1 Description - Refer to example A.

3.2.1.1 Reading from right to left the first three switch segments are tenths, units, and tens of degrees respectively. These switches each have ten positions and are labeled 0 through 9. The fourth switch segment is hundreds of degrees and is marked 0, 1, and 2.

3.2.1.2 The fifth switch is marked (+) and (-). In the (+) position, all settings dialed in on the other segments will be greater than 000.0°C. In the (-) position the inverse will be true.



Example A

3.3 Calibration

3.3.1 Install a temperature sensor (thermocouple, resistance temperature detector, or thermistor) with the proper sensor leads in the center of the temperature chamber workspace and close the door. Connect the leads to an appropriate pyrometer or other suitable temperature measuring device.

3.3.2 Switch the controller POWER switch to the ON position. Compare the temperature displayed on the Controller with the temperature on the recorder. On the Controller P.C. board 970 (D1644528), adjust the "AMBIENT" potentiometer (R24) until the digital display temperature agrees with the recorder temperature.

3.3.3 Switch the Controller HEAT switch to the ON position. Set the digital thumbwheel switches to +100°C. Allow time for the temperature to stabilize. On the Controller P.C. board 970 (D1657058), adjust the "SLOPE" potentiometer (R9) until the digital display temperature agrees with the recorder temperature.

3.3.4 The System is now calibrated. Verify the calibration by randomly selecting a test temperature. Allow the chamber to stabilize and verify that the actual temperature as shown on the recorder agrees with what is set on the Controller.

3.4 Changing Temperature Readout

The controller as supplied provides readout in °C. The settings of the eight-position DIP Switch S1 can be changed to provide readout in °Kelvin or °Farenheit as follows:

CAUTION

Do not use a lead pencil to change DIP switch settings, since conductive graphite may short out the switch.

3.4.1. To change to Farenheit readings, move Section 1 of DIP switch S1 to the YES position.

3.4.2. To change to Kelvin readings, move Section 3 of DIP switch S1 to YES.

3.4.3. To return to Centigrade readings, return switch to original position.

3.5 Running Diagnostics

An automated means of exercising and testing the controller may be accessed through DIP switch S1, Section 2, as follows.

3.5.1. Switch AC power off and unplug any accessories connected to the controller such as a rate programmer or IEEE-488 interface.

3.5. Running Diagnostics (Cont.)

3.5.2. Move Section 2 of DIP switch S1 to YES position.

3.5.3. Dial +000.0 (or +0000) on the setpoint switch and switch on the controller's AC power.

3.5.4. Verify that each digit of the temperature display cycles through its entire character set (0-9, -, E,H,L,P) except for the most significant digit, which will not display the character "0". After cycling the display, the diagnostic program will momentarily turn on decimal point 1 (xxx.x), decimal points 3 & 0 (x.xxx.), the NULL, HEAT, and COOL outputs in sequence.

NOTE

Dialing a "1" in the least significant setpoint decade causes the program to expedite to Step 4. Dialing a "9" causes it to skip Step 4 altogether.

3.5.5. Upon completion of Step 4, the program will echo the number dialed on the setpoint switch back to the display. Decimal point 1 (xxx.x) will be on. the three digit number to the left of the decimal point will be continuously transmitted to the current loop output. Dialing a number in the range of 0 to 255, inclusive will vary the current output from minimum (normally 4mA) to maximum (normally 20 mA).

NOTE

If any of the special codes (-37XX) called for in the following steps are dialed on the setpoint switches, the program will exit in Step 5.

3.5.6. Dial -3700 on the setpoint switches. The status of the A/D converted "data valid" output will appear on the temperature display as an alternating "H" and "L", indicating a logic high and low, respectively. As this cycle repeats 7-1/2 times per second, a flicker is barely discernible.

3.5.7. Dial -3701. The A/D converter data output will appear on the temperature display in decimal form. The range of its output extends from -4095 to +4095 decimal. An input voltage greater than that which generates +4095 will cause the message, "P.OP" to appear on the display. This indicates that the converter's FAIL output is operating properly.

NOTE

Negative displays will not show the thousands digit, as that space is occupied by the sign. The differential amplifier will typically limit the negative range to something higher than the -4095 point.

3.5.8. Dial -3702. Three "H's" will appear on the display. If the pads for jumper A on the controller board are shorted together, the left hand "H" will change to "L", indicating a logic low, or ground on Z1-34. If the SETPOINT VALID line on the accessory interface socket is grounded, the center "H" will change to an "L". If the READ TEMP line on the accessory interface socket is grounded, the righthand "H" will change to an "L". The latter two checks can be used to verify correct operation of the interface handshake lines.

3.5.9. Dial -3712. This code causes suppression of the program's autocheck "heartbeat" output, simulating entry into a "limbo" state or illegal endless loop. Absence of the autocheck heartbeat for 4 seconds causes the auto-restart circuit, Z2, to issue a power ON reset to the CPU to enable it to recover. The program will then revert to the operation described in Step 4.

3.5.10. Dialing a -3711 at any time causes operation to revert to that described in Step 4.

3.5.11. All hardware operation has been verified except for the bidirectional computer interface and differential amplifier and cold junction calibration. An error in normal operation not detected by the above procedure requires replacement of the temperature controller program IC in socket Z1.

3.5.12. Return DIP switch S2 to NO position before resuming normal operation.

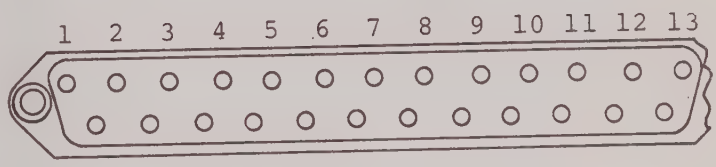
4. PROGRAMMING

4.1 Description

4.1.1 The external program socket pinouts are shown below. On chamber installations, the Controller microcomputer will utilize the information at this connector when the front panel REMOTE SETPOINT switch is activated (LED illuminated). For other installations, refer to Para. B of Pin 23 below. The connector will accept 16 lines I/O plus 2 handshake lines. The I/O lines may be steady state (BCD), latched input or computer I/O lines may be steady state (BCD), latched input or computer interface. Optional interface provides IEEE 488 Bus connections.

EXTERNAL PROGRAM SOCKET PINOUTS

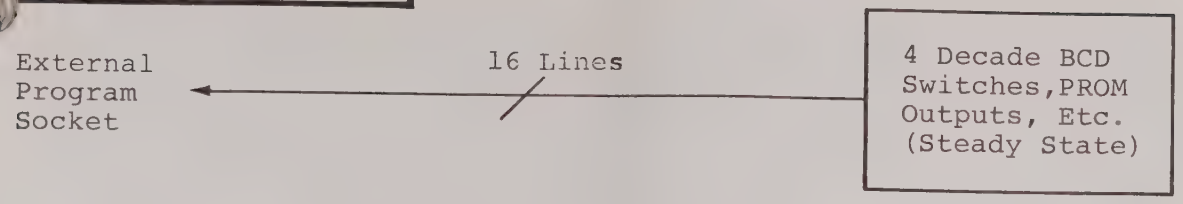
Pin #	Function
1	1
14	2
2	4
15	8 — tenths (BCD)
3	1
16	2
4	4
17	8 — units (BCD)
5	1
18	2
6	4
19	8 — tens (BCD)
7	1
20	2
8	4 — hundreds (BCD)
21	Sign (logic) "1" signifies a minus temperature
9, 22, 10	0 Volt (ground reference)
11	$\overline{\text{Null}}$ (logic) temperature difference between setting and actual system temperature greater than 1.6°C causes logic "1"
24	$\overline{\text{Temperature Interrogate}}$ (logic handshake line for external temperature reading)
12	Spare
25	Setpoint Valid (logic handshake for external temperature setpoint input)
13	+5V (50 ma. max.) Typically not connected to external units.
23	$\overline{\text{Remote}}$ A. For Chambers - When front panel REMOTE switch is depressed, the Remote signal goes low. B. For External Operation - Pin 23 must be grounded.



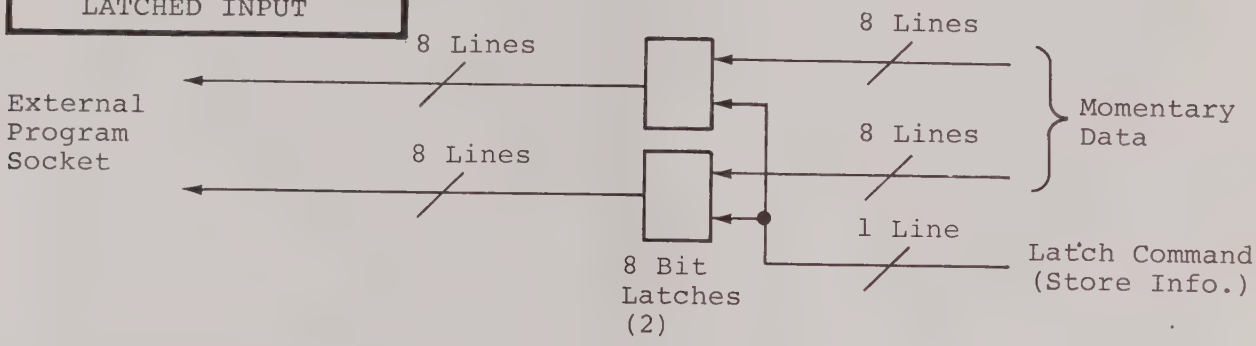
View looking at male interface connector

INTERFACE CAPABILITIES
(All data in parallel format)

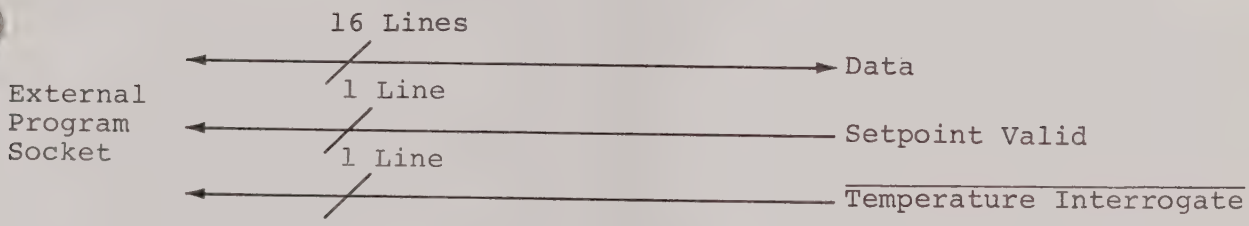
STEADY STATE (BCD)



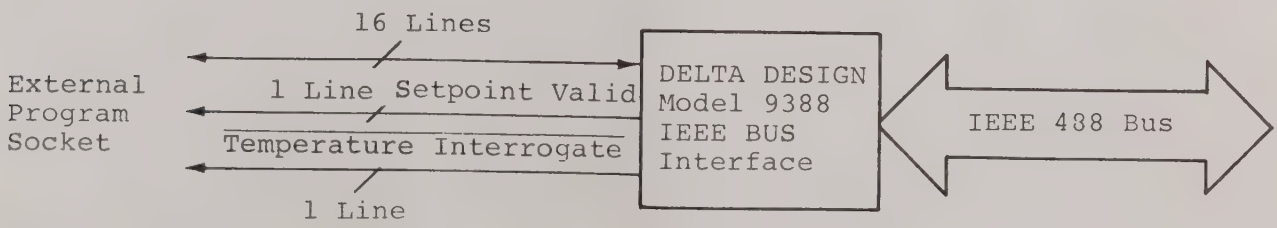
LATCHED INPUT



COMPUTER INTERFACE



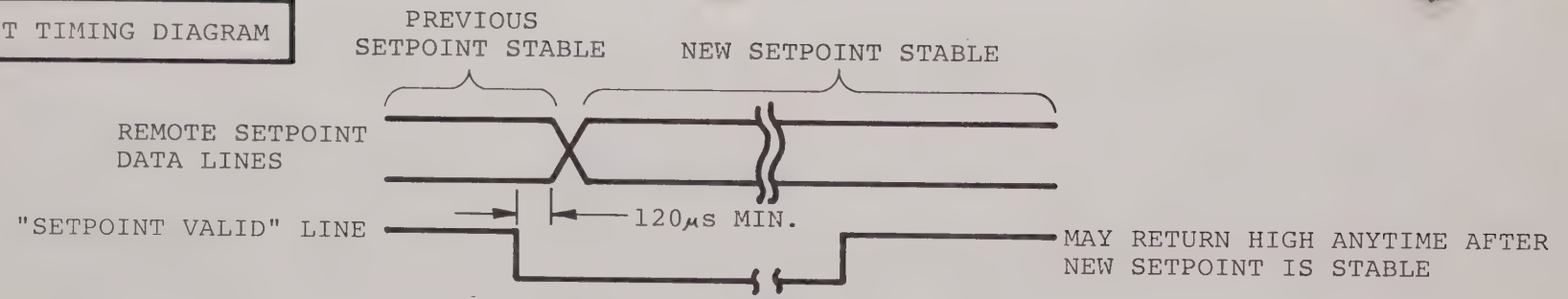
IEEE 488 BUS INTERFACE



5 WARRANTY

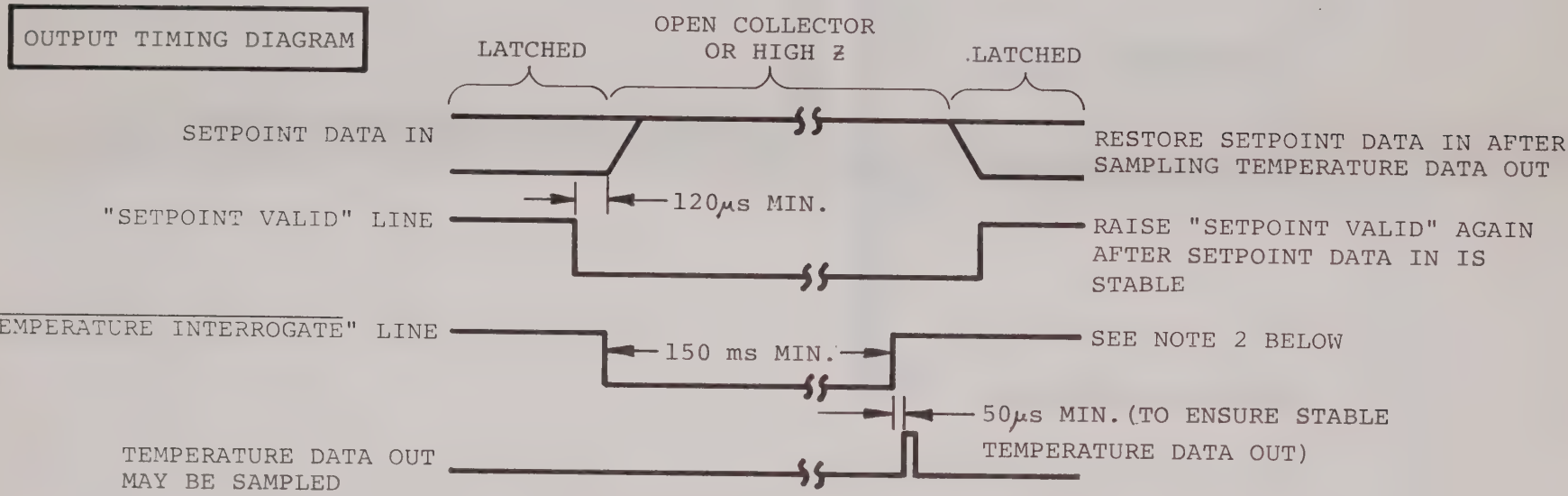
Delta Design, Inc. guarantees all products manufactured and sold by it to conform to published specifications and against defective material and workmanship for a period of 90 days from the date of our shipment. Temperature chambers and electronics are warranted for one year from date of shipment. All contactor assemblies are warranted for a period of 90 days or 1/2 million cycles. Obligation under these warranties is limited to repair or replacement by Delta at its plant or one of its authorized service stations, on any of our products which Delta determines to be defective or not in accord with stated specifications. Delta will not accept responsibility for any defect caused by improper use, nor will Delta assume liability for any unauthorized repairs or modifications to its products or materials, even though defective or not in accord with the specifications. In no case will responsibility extend to products, materials, or equipment not manufactured by Delta. All products to be returned to Delta's plant for warranty repair must have prior written approval from Delta Design, Inc., and all return transportation charges will be at the buyer's expense. Delta will not accept liability for any unauthorized returns. No liability will be accepted for any damages to customer's materials, and equipment due to the use or misuse of Delta's products, nor for any loss of profits or other special damages. Delta Design, Inc., reserves the right to change price, design features and/or specifications without notice.

INPUT TIMING DIAGRAM


PREVIOUS SETPOINT STABLE
NEW SETPOINT STABLE
REMOTE SETPOINT DATA LINES
"SETPOINT VALID" LINE
120μs MIN.
MAY RETURN HIGH ANYTIME AFTER NEW SETPOINT IS STABLE

NOTE 1. THE CONTROLLER SAMPLES THE REMOTE LINES ONCE EVERY 1.2 SECONDS. IF "SETPOINT VALID" IS FALSE AT THAT TIME, IT WILL HOLD THE PREVIOUS SETPOINT UNTIL THE NEXT SAMPLE.

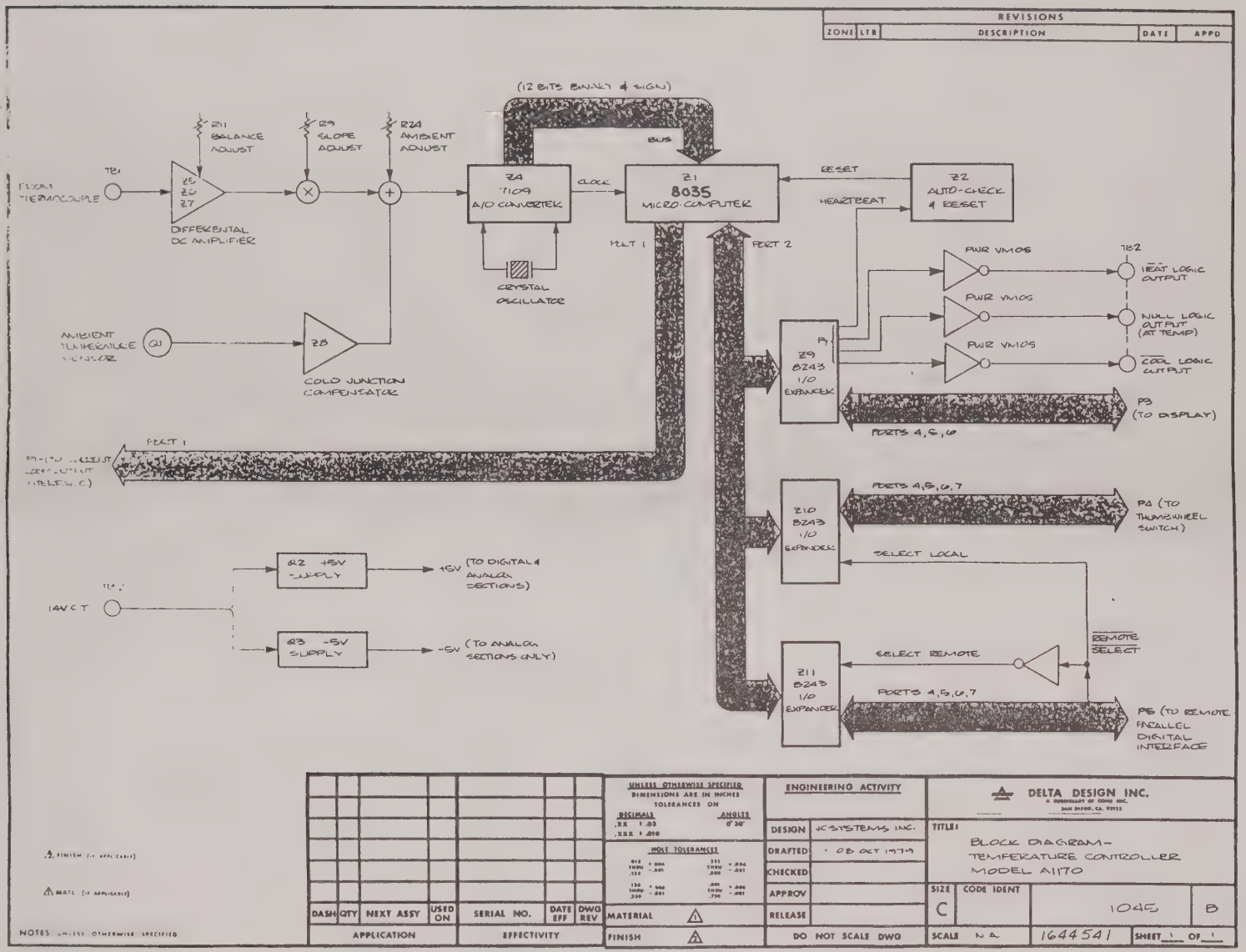
OUTPUT TIMING DIAGRAM


LATCHED
OPEN COLLECTOR OR HIGH z
LATCHED
SETPOINT DATA IN
RESTORE SETPOINT DATA IN AFTER SAMPLING TEMPERATURE DATA OUT
120μs MIN.
"SETPOINT VALID" LINE
RAISE "SETPOINT VALID" AGAIN AFTER SETPOINT DATA IN IS STABLE
"TEMPERATURE INTERROGATE" LINE
150 ms MIN.
SEE NOTE 2 BELOW
50μs MIN. (TO ENSURE STABLE TEMPERATURE DATA OUT)
TEMPERATURE DATA OUT MAY BE SAMPLED

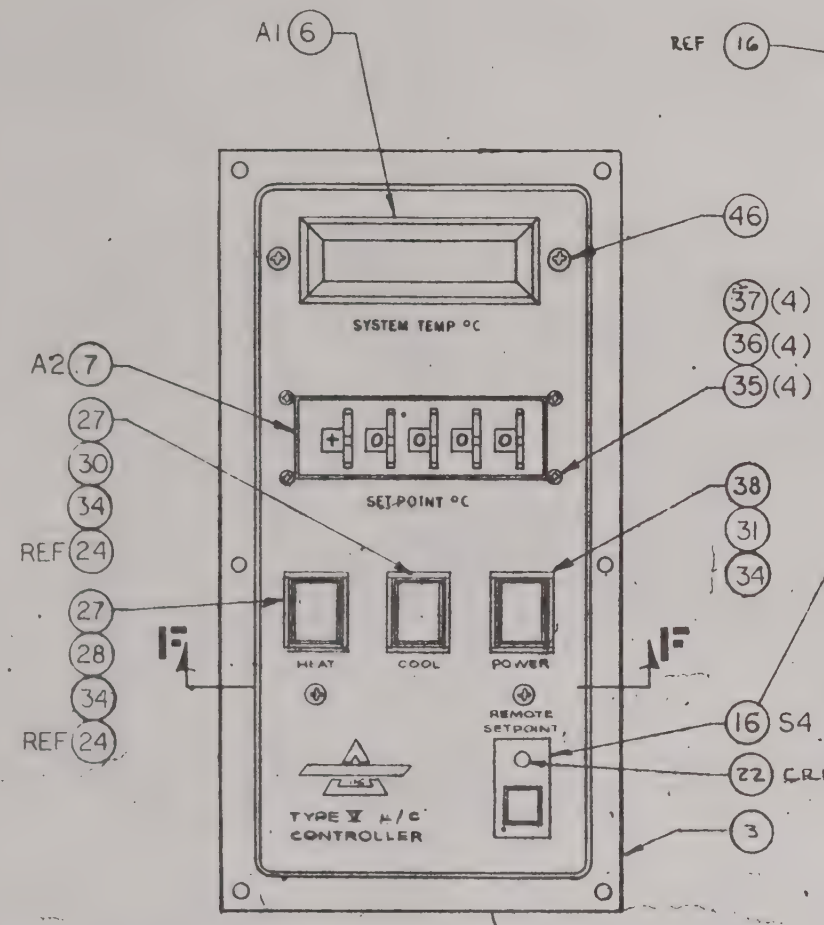
NOTE 2. TEMPERATURE DATA OUT IS SAMPLED EVERY 150 ms AS LONG AS "$\overline{\text{INTERROGATE}}$" AND "VALID" ARE HELD LOW. DATA OUT IS LATCHED WITHIN 50 μs AFTER "$\overline{\text{INTERROGATE}}$" RETURNS TO ITS HIGH LEVEL, AND IT REMAINS LATCHED UNTIL "VALID" GOES HIGH OR UNTIL "$\overline{\text{INTERROGATE}}$" AGAIN GOES LOW.

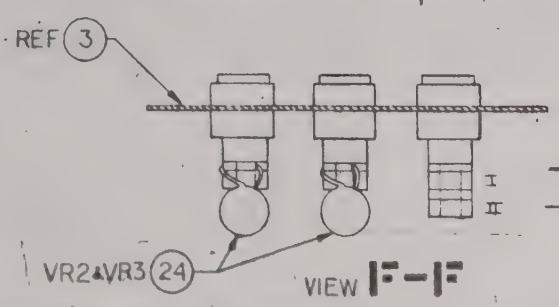
NOTE 3. THE PERIOD BETWEEN INTERROGATE CYCLES SHOULD BE >1.2 SECONDS. (SEE NOTE 1)

TIMING DIAGRAM-BIDIRECTIONAL PARALLEL BCD BUS
SK1046

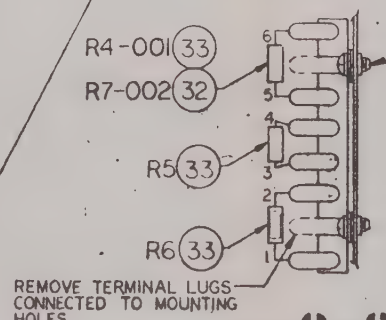

REVISIONS
ZONE LTR DESCRIPTION DATE APPD
(12 BITS BINARY & SIGN)
BUS
R11 BALANCE ADJUST
R9 SLOPE ADJUST
R24 AMBIENT ADJUST
TB1
FROM THERMOCOUPLE
Z5 Z6 Z7
DIFFERENTIAL DC AMPLIFIER
Z4 7109 A/D CONVERTER
CLOCK
Z1 8035 MICRO-COMPUTER
RESET
Z2 AUTO-CHECK & RESET
HEARTBEAT
CRYSTAL OSCILLATOR
PORT 1
PORT 2
AMBIENT TEMPERATURE SENSOR
Q1
Z8
COLD JUNCTION COMPENSATOR
PWR VMOS
TB2
HEAT LOGIC OUTPUT
PWR VMOS
NULL LOGIC OUTPUT (AT TEMP)
PWR VMOS
COOL LOGIC OUTPUT
P1
Z9 8243 I/O EXPANDER
P3 (TO DISPLAY)
PORTS 4,5,6
PORT 1
P2 (TO CONTROL LOGIC OUTPUT INTERFACE)
PORTS 4,5,6,7
P4 (TO THUMBWHEEL SWITCH)
Z10 8243 I/O EXPANDER
SELECT LOCAL
TB1
14VCT
Q2 +15V SUPPLY
+15V (TO DIGITAL & ANALOG SECTIONS)
Q3 -5V SUPPLY
-5V (TO ANALOG SECTIONS ONLY)
SELECT REMOTE
REMOTE SELECT
Z11 8243 I/O EXPANDER
PORTS 4,5,6,7
P5 (TO REMOTE PARALLEL DIGITAL INTERFACE)
DASH QTY NEXT ASSY USED ON
APPLICATION
SERIAL NO. DATE EFF DWG REV
EFFECTIVITY
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 0° 30'
HOLE TOLERANCES
MATERIAL
FINISH
ENGINEERING ACTIVITY
DESIGN JC SYSTEMS, INC.
DRAFTED 08 OCT 1979
CHECKED
APPROV
RELEASE
DO NOT SCALE DWG
DELTA DESIGN INC.
A SUBSIDIARY OF CENCO INC.
SAN DIEGO, CA. 92123
TITLE: BLOCK DIAGRAM - TEMPERATURE CONTROLLER MODEL A1170
SIZE C
CODE IDENT
1045
B
SCALE N.A.
1644541
SHEET 1 OF 1
NOTES UNLESS OTHERWISE SPECIFIED

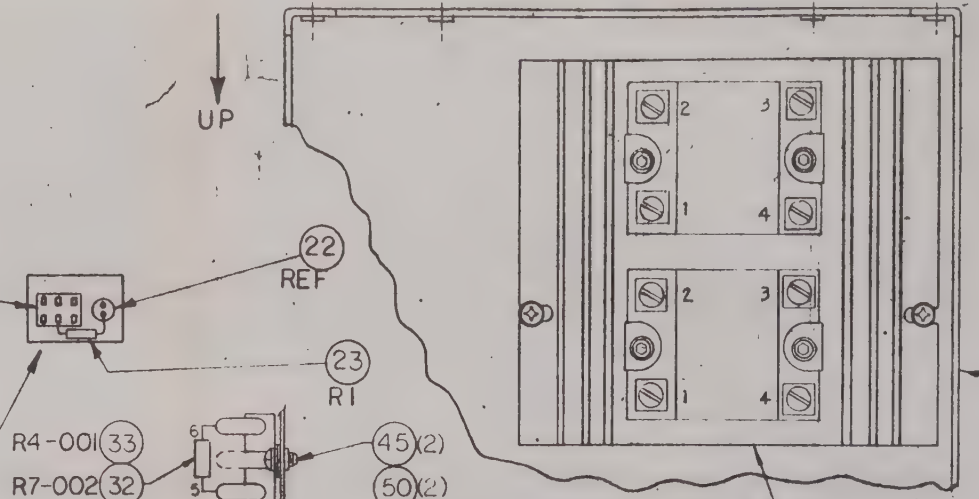
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD

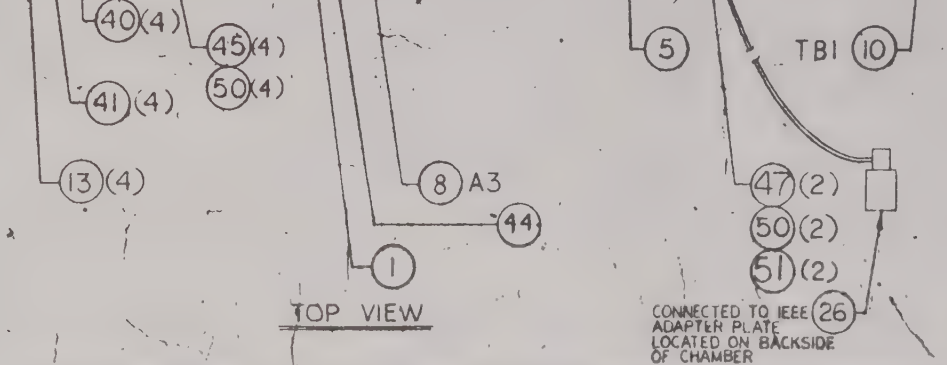




-001 (120V)
-002 (208/240V)







3. REF - FOR THERMOCOUPLE B1650230 SEE DRAWINGS AND P/Ls D1650238 & D1650223.

FINISH (IF APPLICABLE)

2. TEMPERATURE RANGE SELECTION FOR THIS CONTROLLER IS MADE AT ITEM 8 SEE DRAWING D1644528 (SCE 370)

MATL (IF APPLICABLE)

FOR 120,208 OR 240 V WIRING, VERTICAL PANAL, SEE 1650191
FOR 208 OR 240 V WIRING, HORIZONTAL PANEL, SEE 1650202

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
002	1	END ITEM	570-3
001	1	END ITEM	A
APPLICATION			

SERIAL NO. | DATE EFF | DWG REV
EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES ± 00'
HOLE TOLERANCES

MATERIAL
FINISH

ENGINEERING ACTIVITY L 3
ECN 5193

DESIGN	
DRAFTED	D. NELSON 2-29-84
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

DELTA DESIGN, INC.
A SUBSIDIARY OF CONRAC INC.
SAN DIEGO, CA. 92123

TITLE: TYPE V CONTROLLER ASSY - (CHAMBER 120V & 208/240V VERTICAL)

SIZE D | CODE IDENT | 1056972 | REV

SCALE FULL | 12 | SHEET | OF

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD

CONNECTED TO IEEE ADAPTER PLATE LOCATED ON BACKSIDE OF CHAMBER

VIEW A-A

-003 (208/240V)

REMOVE TERMINAL LUGS CONNECTED TO MOUNTING HOLES

VIEW D-D

VIEW E-E

VR2 & VR3

SYSTEM TEMP °C

SET POINT °C

TYPE Σ µ/C CONTROLLER

REMOTE SETPOINT

HEAT

COOL

POWER

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS XX ± .03 XXX ± .010 ANGLES 0° 30' HOLE TOLERANCES

ENGINEERING ACTIVITY 5193 L-3

DESIGN

DRAFTED

CHECKED

APPROV

RELEASE

DO NOT SCALE DWG

MATERIAL ⚠

FINISH ⚠

DELTA DESIGN INC.

A SUBSIDIARY OF SCIENCE INC. SAN DIEGO, CA. 92123

TITLE: TYPE V CONTROLLER ASSY (CHAMBER, 208/240 HORIZONTAL)

SIZE D | CODE IDENT | 166972 | REV

SCALE FULL | 13 | SHEET 2 OF 2

003 | END ITEM | QTY | NEXT ASSY | USED ON | SERIAL NO. | DATE REP | DWG REV

APPLICATION | EFFECTIVITY

PL 1656972 REV ___ SHT 1 OF 3
DESCRIPTION TYPE V CONTROLLER
NEXT ASSY END ITEM BY RANGE CK'D ___ APPD 9/11/84

REV ECN DATE BY APP

DELTA DESIGN
5725 KEARNY VILLA RD.
SAN DIEGO, CALIF.

JOB NO. ___ S.O. NO. ___
QTY ___ PROM DATE ___ ACT ___
RUN * ___ MACH ___

ITEM NO	ASSY & QTY -001	-002	-003	-004	INDENTURE	SIZE	DRAWING NO.	REV	DESCRIPTION	MFG OR MFG NO.	STOCK OR PART NO.	JOB QTY	ALL	QTY REC	FAB CD	PURCHASING P.O. NO.	QTY.	DUE	REC'D	MANUFACTURE ACT	EST ACT	STD. HRS.	COM.	COM	PLATE/PAINT IN	OUT	AREA
00	X					D	1656972		TYPE V CONTROLLER, VERTICAL, 120V	MODEL A1570-1 CHAMBER	1656972-001																
00		X				D	1656972		TYPE V CONTROLLER, VERTICAL, 208/240V	MODEL* A1570-3 CHAMBER	1656972-002																
00			X			D	1656972		TYPE V CONTROLLER, HORIZONTAL, 208/240V	MODEL* A1570-4 CHAMBER	1656972-003																
00																											
00																											
00																											
00	REF	REF				D	1656973		WIRING DIAGRAM,	120/208/240V																	
00			REF			D	1656974		WIRING DIAGRAM, HORIZ	208/240V																	
00																											
00																											
00																											
00																											
01	1	1				D	1650161		CHASSIS ASSY, VERTICAL		1650161-001																
01	1	1				D	1650161		CHASSIS, VERTICAL		1650161-101																
02	4	4				D	1650161		BRACKET	.036 (20 GA C.R.S.)	1650161-102																
03	9	9							#6-32 WELDNUT		1500175																
02			1			D	1650204		CHASSIS ASSY, HORIZONTAL		1650204-001																
01			1			D	1650204		CHASSIS, HORIZONTAL		1650204-101																
02			4			D	1650204		BRACKET	.036 (20 GA C.R.S.)	1650204-102																
03			9						#6-32 WELDNUT		1500175																
03	1	1				C	1650162		FRONT PANEL, VERTICAL		1650162-101																
	REF	REF				B	1650159		ARTWORK, FRONT PANEL, VERTICAL																		
04			1			C	1650203		FRONT PANEL, HORIZONTAL		1650203-101																
			REF			C	1650196		ARTWORK, FRONT PANEL, HORIZONTAL																		
05	1	1	1			D	1653316		CENTER BRACKET		1653316-101																
06	1	1	1			B	1650192		PCB NUMERIC DISPLAY A1	JCE* A1003	0900002																
	REF	REF	REF			C	1650193		SCHEMATIC	JCE* 1002																	
07	1	1	1			B	1644549		PCB TEMP DIGI-SWT A2	JCE* A998	0900003																
	REF	REF	REF			B	1644548		SCHEMATIC	JCE* 997																	

NOTES: 1 REF - FOR THERMOCOUPLE B1650230 SEE DRAWINGS AND P/Ls D1650238 & D1650223.

1656972
P/L

REV

P.L. 1656972 REV ____ SHT 2 OF 3

DESCRIPTION TYPE V CONTROLLER

NEXT ASSY END ITEM BY RANGE CK'D ____ APPD C Lee

REV ECN DATE BY APP.

DELTA DESIGN
5725 KEARNY VILLA RD.
SAN DIEGO, CALIF.

JOB NO. ____ S.O. NO. ____

QTY ____ PROM DATE ____ ACT ____

RUN * ____ MACH ____ ____ ____

ITEM NO	ASSY & QTY -001	-002	-003	-004	INDENTURE	SIZE	DRAWING NO.	REV	DESCRIPTION	MFG OR MFG NO.	STOCK OR PART NO.	JOB QTY	ALL	QTY REC	FAB CD	PURCHASING P.O. NO.	QTY DUE	REC'D	MANUFACTURE ACT STD HRS	EST ACT COM	COM	PLATE/PAINT IN	OUT	APPLY
08	1	1	1						PC BOARD ASSY A3	JCE # 1570	0900149													
	REF	REF	REF						SCHEMATIC	JCE # 1169														
09	1	1	—			B	1654248		RELAY ASSY, SOLID STATE	(MULTI-USAGE)	1654248-002													
10	2	2	2						TERMINAL BD TB1 & TB2		1400520													
11			1						SOLID STATE RELAY		1400194													
12	1	1	1						TERMINAL STRIP TP1		1400506													
13	4	4	4						STANDOFF	FORGE # 350-1308-18-07-00	4100092													
14																								
15																								
16	1	1	1						SWITCH S4	CEK # 8261J82	1400180													
17																								
18																								
19																								
20	1	1	1						FUSE HOLDER XF1	LITTLE FUSE # 356001	1400053													
21	1	1	1						FUSE 1AMP F1	LITTLE FUSE # 314001	1400030													
22	1	1	1						LED CR1	MV5752	1400347													
23	1	1	1						RESISTOR 680Ω ½W	R1	0368000-500													
24	3	3	3						VARISTOR VR2, VR3 & VR8	GE # V180ZA10	1400010													
25	1	1	1						TRANSFORMER T1	JC SYSTEM # 241-6-1456	0900005													
26	1	1	1						CABLE ASSY	C801835 JC SYSTEM	0900004													
27	2	2	2						SWITCH MAINTAINED	EAD # 31-261	1400167													
28	1	1	1						LENS CAP RED	EAD # 31-901.2	1400168													
29																								
30	1	1	1						LENS CAP BLUE	EAD # 31-901.6	1400169													
31	1	1	1						LENS CAP WHITE	EAD # 31-901.9	1400170													
32		1	1						RESISTOR 8.2K 3WATT R7	DALE	0600005													
33	3	2	2						RESISTOR 2.7K 3WATT R4,	R5, R6 DALE	0302723-500													
34	3	3	3						LAMP 60V .02 AMP	EAD # 31-963.4	1400085													
35	4	4	4						#2-56 x 3/8 PHP-MS		6802563-804													
36	4	4	4						#2-56 HEX NUT		6702560-001													
37	4	4	4						#2 SPLIT LOCK WASHER		6602010													
38	1	1	1						SWITCH MAINTAINED	EAD # 31-262	1400171													

NOTES

1656972
P/L

REV

PL. 1656972 REV ____ SHT 3 OF 3

DESCRIPTION TYPE V CONTROLLER

NEXT ASSY ____ BY ____ CK'D ____ APPD C Lee

REV	ECN	DATE	BY	APP

DELTA DESIGN
5725 KEARNY VILLA RD.
SAN DIEGO, CALIF.

JOB NO. ____ S.O. NO. ____

QTY ____ PROM DATE ____ ACT ____

RUN * ____ MACH ____

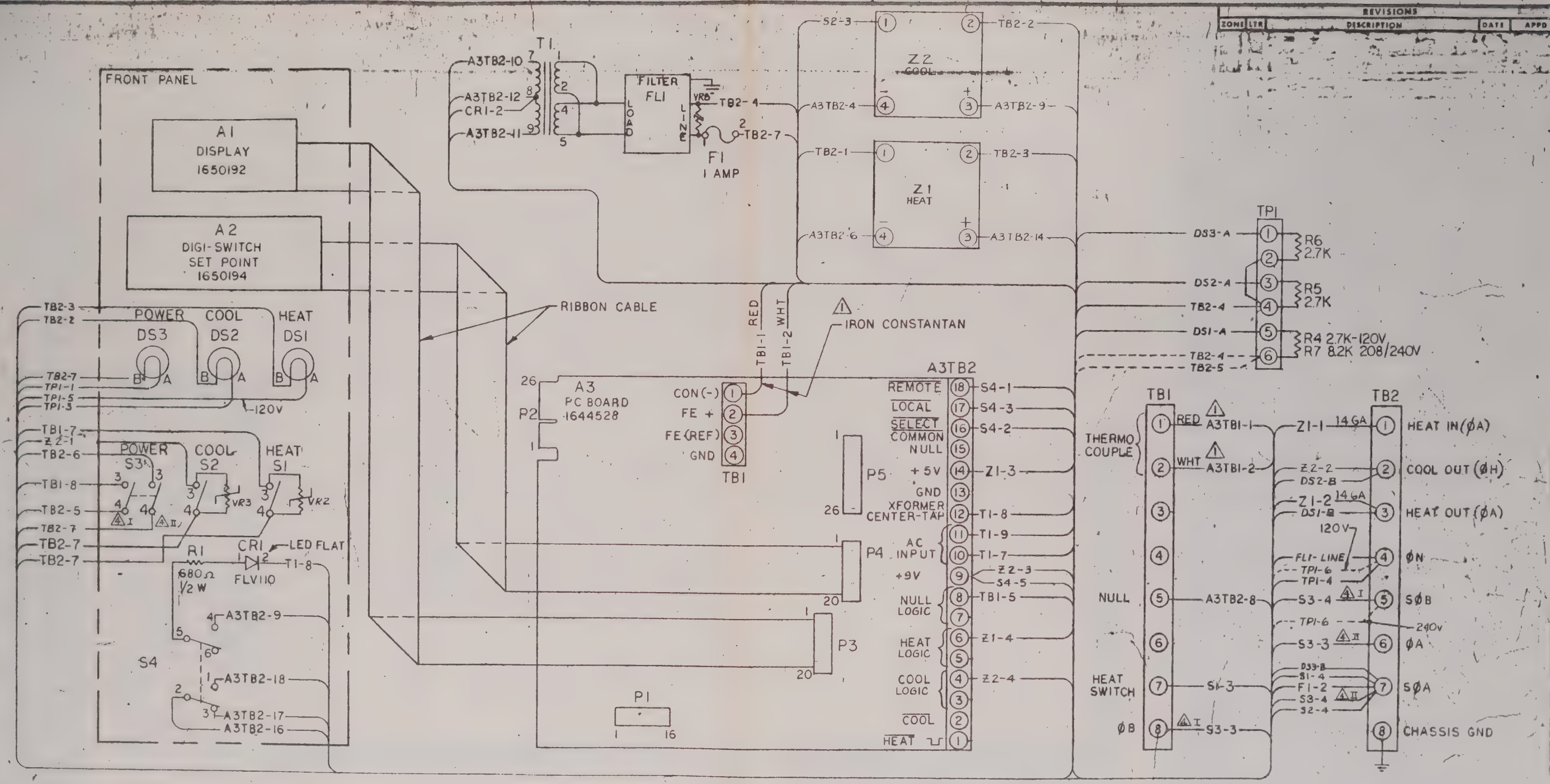
ITEM NO	ASSY & QTY -001	-002	-003	-004	INDENTURE	SIZE	DRAWING NO.	REV	DESCRIPTION	MFG OR MFG NO.	STOCK OR PART NO.
39	1	1	1						FILTER	FILTER CONCEPTS SC3	1400096
40	4	4	4						*4-40 x 1/4 PHP-MS		6804401-404
41	4	4	4						*4 FIBER WASHER		6604008
42											
43											
44	1	1	1						*6-32 x 3/8 FHP-MS		6806323-801
45	10	10	14						*6-32 x 1/4 PHP-MS		6806321-404
46	4	4	4						*6-32 x 1/4 BHS-MS		6806321-499
47	2	2	2						*6-32 x 3/8 PHP-MS		6806323-804
48	4	4	4						*6-32 x 1/2 PHP-MS		6806321-204
49	1	1	1						*6-32 HEX NUT		6706320-001
50	9	9	9						*6 SPLIT LOCK WASHER		6606010
51	2	2	2						*6 FLAT WASHER		6606000
52											
53			A/R						THERMAL COMPOUND		9900026
54											
55											
56											
57											
58											
59											
60											
61											
62											
63											
64											
65											
66											
67											
68											
69											
70											
71											

JOB QTY	AUL	QTY REC	FAB CD	PURCHASING P.O. NO.	QTY DUE	REC'D	MANUFACTURE ACT STD HRS	EST ACT COM COM	PLATE/PAINT IN	OUT	AREA

NOTES NO RESISTORS REQ'D ON END POWER SWITCH # 1400171

P/L 1656972 REV

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD



⚠ I & II INDICATE SWITCH LEVELS, I IS NEAREST PUSH BUTTON

3-ALL WIRES 20 AWG TEFLON UNLESS NOTED

⚠ FINISH (IF APPLICABLE)

CONNECTIONS FOR 208 & 240V ARE SAME

⚠ MATL (IF APPLICABLE)

WRAP WIRE AROUND SCREW

NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 ANGLES 0° 30' NOM TOLERANCES	ENGINEERING ACTIVITY ECN 5193	DELTA DESIGN INC. A SUBSIDIARY OF CONIC INC. SAN DIEGO, CA. 92123			
	DESIGN	TITLE: WIRING DIAGRAM 120/208-240 V TYPE V CONTROLLER			
	DRAFTER RANGE 11/16/79				
	CHECKED				
	APPROV				
	RELEASE				
MATERIAL ⚠	DO NOT SCALE DRWG	SIZE D	CODE IDENT	91656973	REV A
FINISH ⚠	SCALE —		SHEET 17	OF	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	ECN 5526 DN	4-24	YC

FRONT PANEL

A1 DISPLAY 1650192

A2 DIGI-SWITCH SET POINT 1650194

TB2-3
TB2-2
POWER DS3 COOL DS2 HEAT DS1
TB2-7
TP1-1
TP1-5
TP1-3
120V
TB1-7
Z2-1
TB2-6
POWER S3 COOL S2 HEAT S1
TB1-8
TB2-5
TB2-7
TB2-7
R1 680Ω 1/2 W
CR1 LED FLAT FLV110
TI-8
A3TB2-9
S4
A3TB2-18
A3TB2-17
A3TB2-16

RIBBON CABLE

T1
A3TB2-10
A3TB2-12
CR1-2
A3TB2-11
FILTER FL1
LOAD
LINE
VRB
TB2-4
TB2-7
F1 1 AMP

S2-3
Z-2
TB2-2
A3TB2-4
A3TB2-9

TB1-1 RED
TB1-2 WHT
1 IRON CONSTANTAN

26
A3 PC BOARD 1644528
P2
1
CON(-)
FE +
FE (REF)
GND
TB1

P4
P3
P1
1
16
20

A3TB2
REMOTE 18 S4-1
LOCAL 17 S4-3
SELECT 16 S4-2
COMMON NULL 15
P5 +5V 14 TB2-8
GND 13
XFORMER CENTER-TAP 12 T1-8
AC INPUT 11 T1-9
10 T1-7
+9V 9 Z2-3
S4-4
NULL LOGIC 8 TB1-5
7
HEAT LOGIC 6 TB2-1
5
COOL LOGIC 4 Z2-4
3
COOL
HEAT
2
1

TP1
DS3-A 1
2 R6 2.7K
DS2-A 3
4 R5 2.7K
TB2-4
DS1-A 5
TB2-5 6 R7 8.2K

THERMO COUPLE
TB1
1 RED 1 A3TBI-1
2 WHT 1 A3TBI-2
3
4
NULL 5 A3TB2-8
6
HEAT SWITCH 7 S1-3
ØB 8 S3-3

TB2
A3TB2-6 1 HEAT RELAY(-)
Z2-2
DS2-B 2 COOL OUT (ØA)
DS1-B 3 HEAT OUT (ØA)
FLI-LINE 4 ØN
TP1-4
S3-4 1 5 SØB
TP1-6
S3-3 II 6 ØA
DS3-B
S2-4
F1-2 II 7 SØA
S3-4
S1-4
A3TB2-14 8 HEAT RELAY (+)

1 I & II INDICATE SWITCH LEVELS, I IS NEAREST PUSH BUTTON

3-ALL WIRES 20AWG TEFLON UNLESS NOTED

~~4 FINISH (IF APPLICABLE)~~

CONNECTIONS FOR 208 & 240V ARE SAME

~~5 MATL (IF APPLICABLE)~~

WRAP WIRE AROUND SCREW

NOTES: UNLESS OTHERWISE SPECIFIED

–	–	1656972					
DASH NO.	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV	
APPLICATION				EFFECTIVITY			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON
DECIMALS .XX ± .05 .XXX ± .010
ANGULAR ± 0° 30'
HOLE TOLERANCES
MATERIAL
FINISH

ENGINEERING ACTIVITY ECN 5193

DESIGN	
DRAFTED	RANGE 11/16/79
CHECKED	
APPROV	
RELEASE	
DO NOT SCALE DWG	

DELTA DESIGN INC.
A SUBSIDIARY OF CONIC INC.
SAN DIEGO, CA. 92138

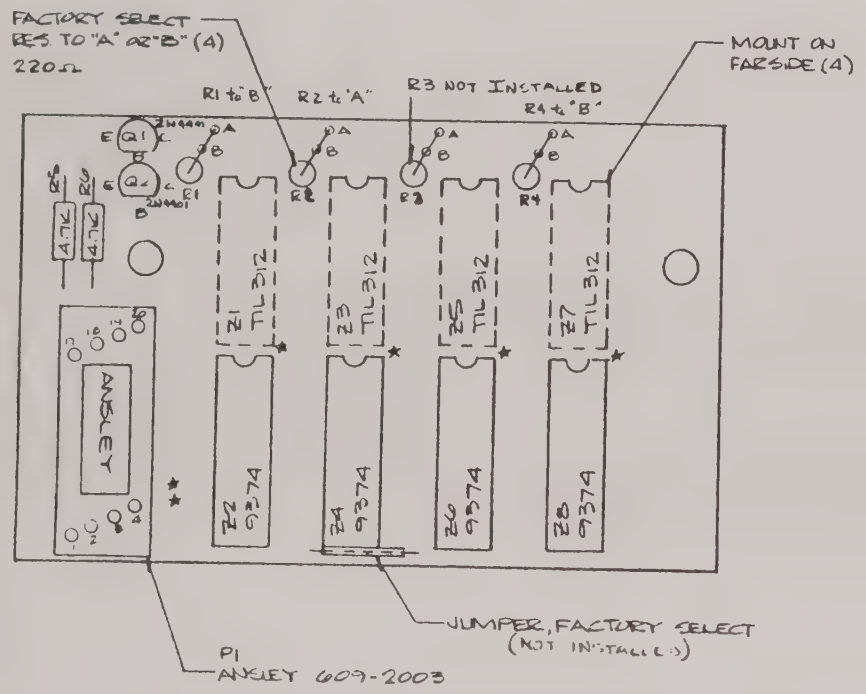
TITLE: WIRING DIAGRAM, 208-240 V TYPE V CONTROLLER

SIZE D | CODE IDENT | 1656974 | REV A

SCALE — | SHEET 18 OF

M/F 1650191 / 1650202

ZONE	LTR	DESCRIPTION	DATE	APPD



3 SCHEMATIC: JCE 1002

4 FINISH (IF APPLICABLE)

5 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
		1650160	
	1	END ITEM	
APPLICATION			

SERIAL NO.	DATE EFF	DWG REV
1 & ON		NIC
EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03, .XXX ± .010
ANGLES ± 30'
HOLE TOLERANCES

MATERIAL 5
FINISH 4

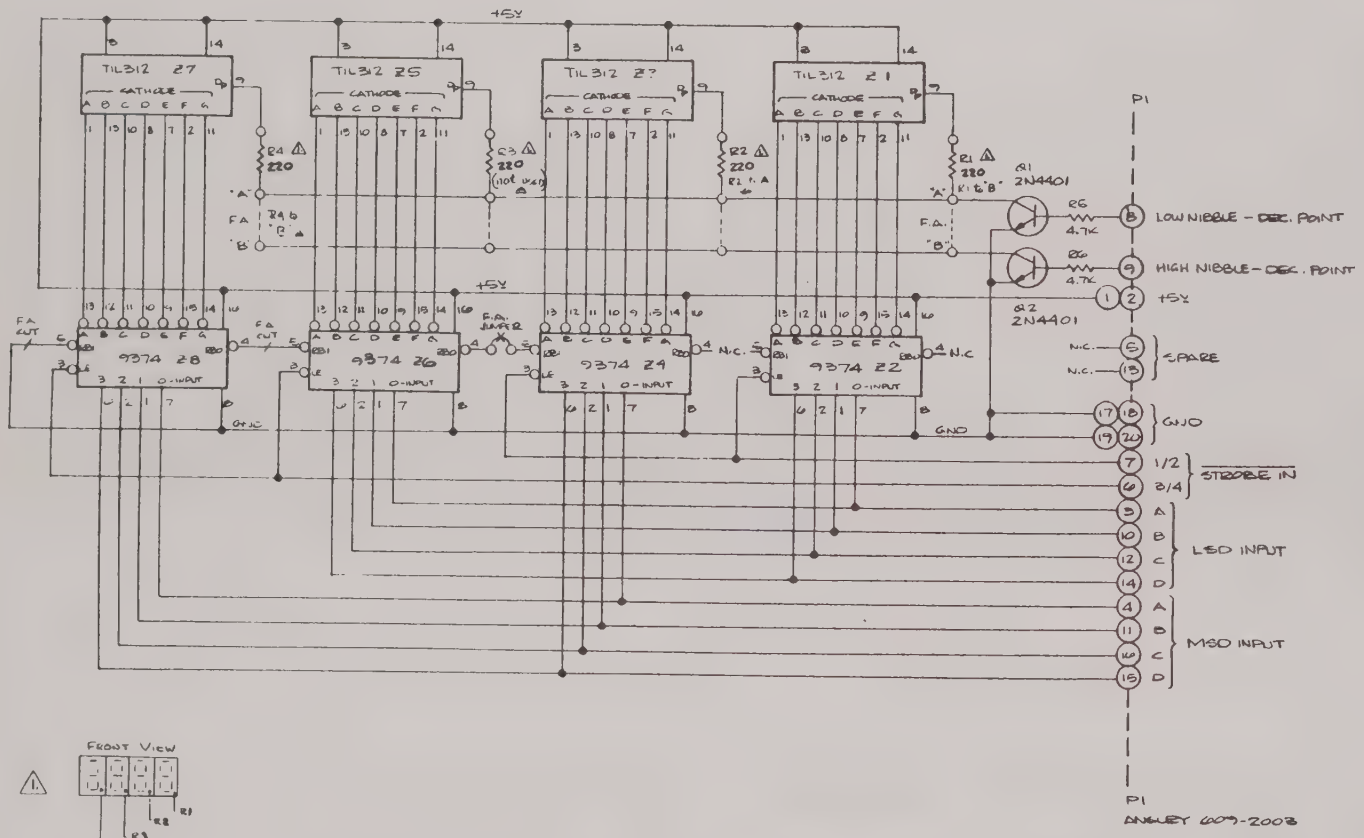
ENGINEERING ACTIVITY		
DESIGN	JC SYSTEMS INC.	
DRAFTED	" 29 JUNE 1979	
CHECKED		
APPROV		
RELEASE		
DO NO SCALE DWG		

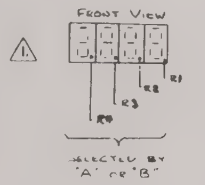
JCE ENTERPRISES
SAN DIEGO, CALIFORNIA

TITLE: PRINTED CIRCUIT BD ASSY — NUMERIC DISPLAY II MODEL A1003

SIZE	CODE IDENT	
B		1003
SCALE 2:1		1650192 SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD





DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
		16501160				
	1	A1002		1 d ON		N/C
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0° 30'
HOLE TOLERANCES

MATERIAL
FINISH
DO NOT SCALE DWG

ENGINEERING ACTIVITY

DESIGN	JC SYSTEMS INC
DRAFTED	" 29 JUNE 1979
CHECKED	
APPROV	
RELEASE	

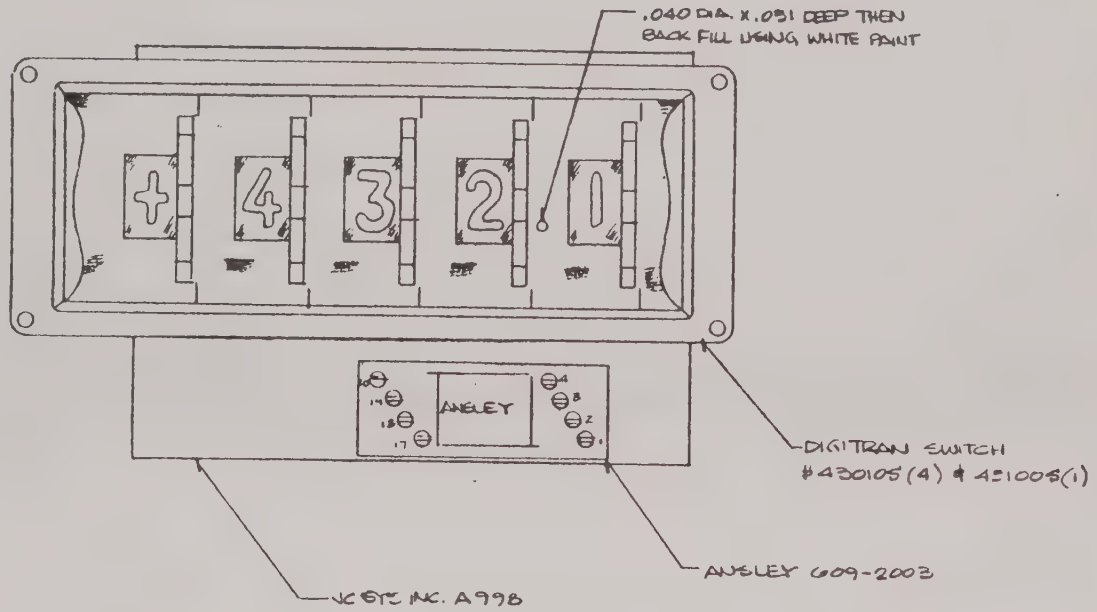
JC ENTERPRISES

TITLE: PRINTED CIRCUIT BD SCH — NUMERIC DISPLAY II MODEL A1003

SIZE	CODE IDENT	
C		1002
SCALE N.A.	16501193	SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

ZONE	LTR	DESCRIPTION	DATE	APPD



3 SCHEMATIC : JCE 997

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
		1650160	
	1	BVD ITEM	

APPLICATION

SERIAL NO.	DATE EFF	DWG REV
1 & ON		N/C

EFFECTIVITY

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0° 30'

HOLE TOLERANCES

MATERIAL ⚠

FINISH ⚠

ENGINEERING ACTIVITY	
DESIGN	JCEYS INC.
DRAFTED	" 2 JUNE 1979
CHECKED	
APPROV	
RELEASE	

DO NO SCALE DWG

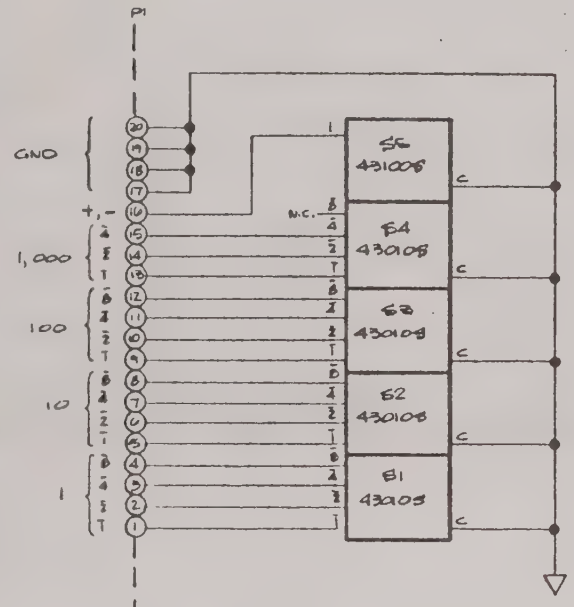
ENTERPRISES

TITLE: PRINTED CIRCUIT BD ASSY - TEMPERATURE DIGI-SWITCH II MODEL A998

SIZE	CODE IDENT	
B		998

SCALE 2:1 | 1644549 | SHEET 1 OF 1

ZONE	LTR	DESCRIPTION	DATE	APPD



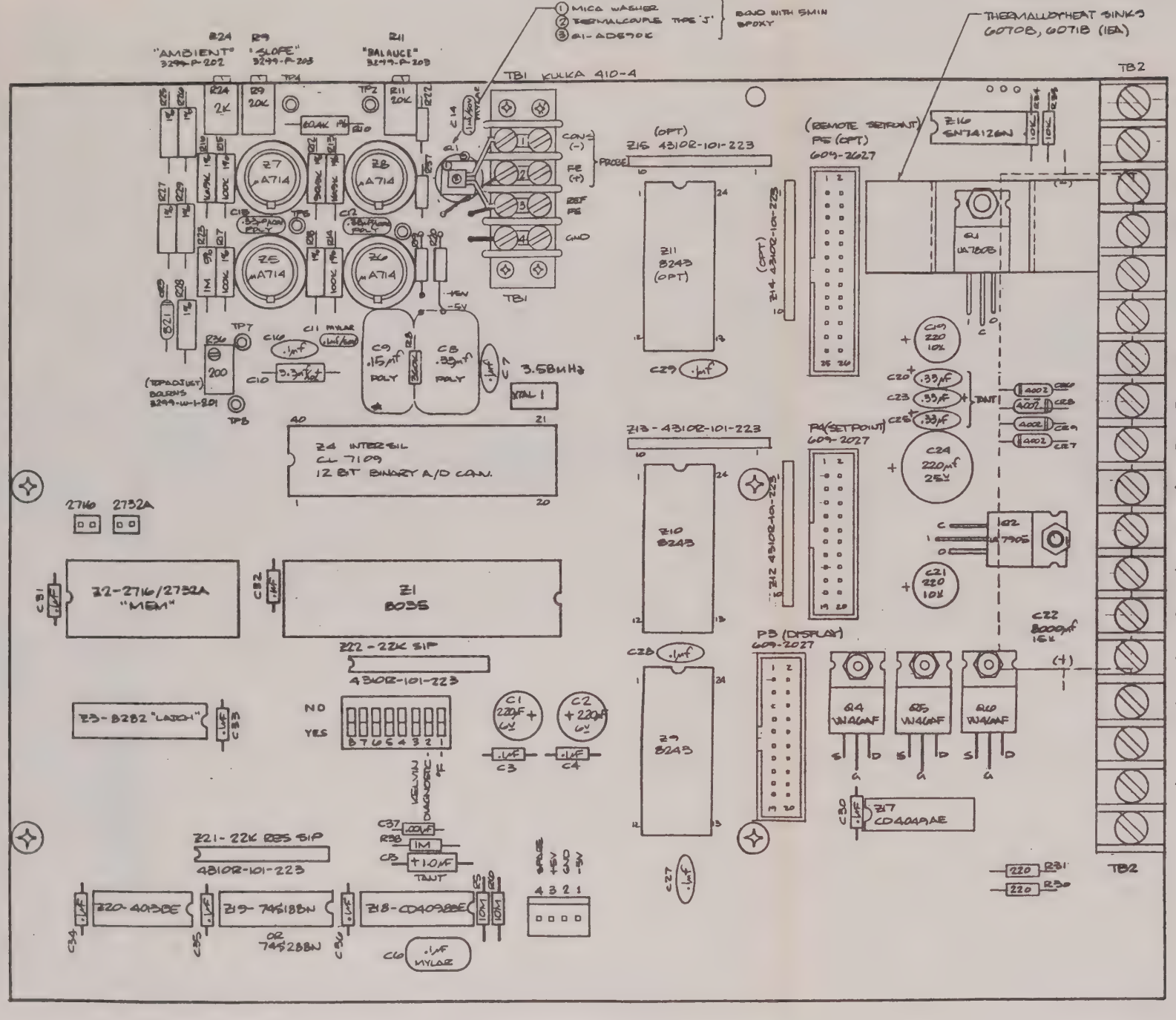
								UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DECIMALS .XX ±.03 .XXX ±.010 ANGLES ±1°	ENGINEERING ACTIVITY		ENTERPRISES 5300 DIEGO CALIFORNIA
									DESIGN	JC SYSTEMS INC	TITLE: PRINTED CIRCUIT BD SCH- TEMPERATURE DIGI-SWITCH II MODEL A998
								MOLE TOLERANCES .0?? ±.004 ±.001 .1?? ±.006 ±.001 .1?? ±.006 ±.001 .2?? ±.008 ±.001	DRAFTED	" 22 JUNE 1979	
		1650160							CHECKED		
	1	A998		1 & UP			N/C		APPROV		SIZE B / CODE IDENT 997
DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV		MATERIAL ⚠	RELEASE		
APPLICATION				EFFECTIVITY				FINISH ⚠	DO NO SCALE DWG		SCALE N.A. / 1649548 / SHEET 1 OF 1

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

ZONE	LTR	DESCRIPTION	DATE	APPD


R24 "AMBIENT" 3299-P-202
R9 "SLOPE" 3299-P-203
R11 "BALANCE" 3299-P-203
TB1 KULKA 410-4
1 MICA WASHER
2 THERMALCOUPLE TYPE 'J'
3 81-AD570K
BOND WITH 5MIN EPOXY
THERMALLOY HEAT SINKS 6070B, 6071B (1EA)
TB2
18 REMOTE
17
16 SELECT COM
15 NULL
14 +5V
13 GND
12 GND XFORMER CT.
11 AC-1
10 AC-2
AC INPUT
9 +9V
8 NULL LOGIC
7 GND
6 HEAT LOGIC
5 GND
4 COOL LOGIC
3 GND
2 COOL
1 HEAT
Z4 INTERSIL CL 7109 12 BIT BINARY A/D CON.
Z1 8035
Z2-2716/2732A "MEM"
Z22-22K SIP
43102-101-223
Z3-8282 "LATCH"
Z21-22K RES SIP
Z20-4013BE
Z19-74LS88N OR 74S288N
Z18-CD4093BE
Z16 SN74126N
Z11 8243 (OPT)
Z10 8243
Z9 8243
Z7 CD4049AE
Z17 CD4049AE
Z14 43102-101-223 (OPT)
Z12 43102-101-223
Z13 - 43102-101-223
P5 (REMOTE SETPOINT) 609-2627
P4 (SETPOINT) 609-2627
P3 (DISPLAY) 609-2027
P6 (OPT) 609-2627
Q1 LM7805
Q2 LM7805
Q4 VN46AF
Q5 VN46AF
Q10 VN46AF
3.58MHz
XTAL 1
C22 8000µF 16V
C20 .33µF
C23 .33µF
C26 .33µF
C24 220µF 25V
C21 220 10V
C19 220 10V
C9 .15µF POLY
C8 .33µF POLY
C10 .3.3µF
C11 MYLAR
C14 .1µF
C1 220µF 6V
C2 +220µF 6V
C3 .1µF
C4 .1µF
C27 .1µF
C28 .1µF
C29 .1µF
C30 .1µF
C31 .1µF
C32 .1µF
C33 .1µF
C34 .1µF
C35 .1µF
C36 .1µF
C37 .001µF
C5 +10µF TANT
C6 .1µF MYLAR
R31 220
R30 220
R36 200
R37 1M
R38 1M
R39 1M
R40 10K
R41 10K
R42 10K
R43 10K
R44 10K
R45 10K
R46 10K
R47 10K
R48 10K
R49 10K
R50 10K
R51 10K
R52 10K
R53 10K
R54 10K
R55 10K
R56 10K
R57 10K
R58 10K
R59 10K

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD

SN74S188N

Z21 22K RES 4310R-101-223

Z22 - 22K RES SIP

S1 DIP SWITCH

°F DIAGNOSTIC KELVIN

Z1 INTEL 8035

Z4 ICL 7109

CD4013BE

CD4098BE

-5V GUARD PLANE

TP4 TP2 TP3 (OPT) TP1 -5V(A) (OPT) TPC TPD

TB1

Q1 AD589JH

TYP PIN OUT FOR μA714 (Z8-Z5)

(A) = ANALOG SECTION

(D) = DIGITAL SECTION

TO UNIT 2

Z2- 2716/2732A "MEM"

Z3- 8282 "LATCH"

P2-

P2 (.100) PANDUIT

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
		1656972	V

APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ±.03 .XXX ±.010 ANGLES 0°30' HOLE TOLERANCES

MATERIAL ⚠ FINISH ⚠

ENGINEERING ACTIVITY 5499 L-3

DESIGN | DRAFTED | CHECKED | APPROV | RELEASE | DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF CONIC INC.
SAN DIEGO, CA. 92123

TITLE: SCHEMATIC, P.C. BOARD TYPE V MODEL A1570

SIZE D | CODE IDENT | 1657059 | REV

SCALE N A | SHEET 1 OF 2

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD

— SEE SHT 1 —

+5V

Z12 22K RES PAC
BOURNS 4310R-101-223

Z13 22K RES PAC
BOURNS 4310R-101-223

Z15 22K RES PAC
BOURNS 4310R-101-223

Z14 22K RES PAC
BOURNS 4310R-101-223

C28 .1μf

C29 .1μf

C27 .1μf

P4 ANSLEY 609-2027

P5 ANSLEY 609-2627

SET POINT SWITCH INTERFACE

TENTHS
UNITS
TENS
HUNDREDS
SIGN "1" = "-"
GND

Z10 8243

Z11 8243 (OPTIONAL)

Z9 8243

P3 ANSLEY 609-2027

DISPLAY INTERFACE

D0 D1 D2 D3 D4 D5 D6 D7

LOW NIBBLE DEC. POINT
HIGH NIBBLE DEC. POINT
DIGIT PAIR 2 STROBE
DIGIT PAIR 1 STROBE

DISPLAY CS → Z1-36
BEEP → Z1-28
SET POINT CS → Z1-35 } TO SHT 1
A → Z1-21
B → Z1-22
C → Z1-23
D → Z1-24
Z9-13

TO SHT 1 { Z1-1, Z1-6

REMOTE TEMP PROGRAM
TENTHS
UNITS
TENS
HUNDREDS
SIGN "1" = +
GND
NULL "1" AT TEMP
READ TEMP
REMOTE CONTROL
SET POINT VALID
+5V
P5

TB2
+9V UNREG
AC-1
AC-2
XFORMER CT. GND

CR10 IN4002 (4)
CR11
CR8
CR9

μA78G5C
μA79G5C

C19 220 10%
C20 .33μF 100%
C21 220 10%
C22 8000 16V
C23 .33μF 100%
C24 220 25V
C25 .33μF 100%
C26 .33μF 100%

CD4049AE (3)

Q4, VN40AF
Q5, VN40AF
Q6, VN40AF

COOL LOGIC
HEAT LOGIC
NULL LOGIC
GND

R30 220
R31 220

SN74LS20N

R32 10K
R33 10K

SPARE CD4049AE INVS

N.C.

TB2 { 16 17 18 15 2 1 — 13 14

SELECT COM
REMOTE
NULL
COOL
HEAT

⚠2 FINISH (IF APPLICABLE)

⚠1 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03, .XXX ± .010
ANGLES 0°30'
MOLY TOLERANCES
.010 THRU .334 +.004 -.001
.335 THRU .500 +.005 -.001
.501 THRU .750 +.005 -.001

MATERIAL ⚠1
FINISH ⚠2

ENGINEERING ACTIVITY 5499 L-3

DESIGN	
DRAFTED	
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

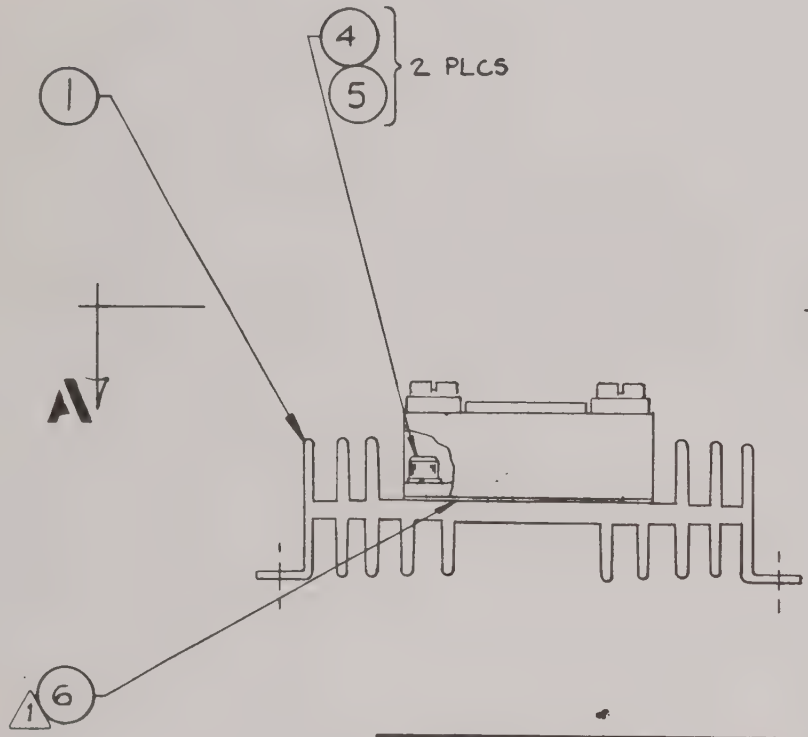
DELTA DESIGN INC.
A SUBSIDIARY OF ICOS INC.
SAN DIEGO, CA. 92123

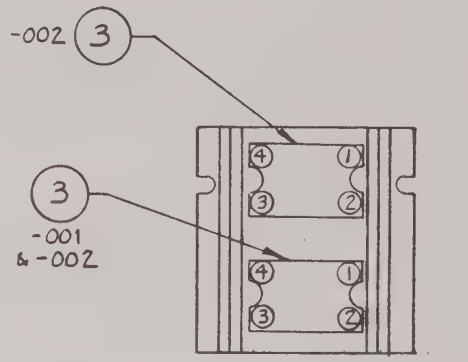
TITLE: SCHEMATIC, P.C. BOARD TYPE V MODEL A1570

SIZE	CODE IDENT		REV
D		1657059	

SCALE N.A. 25 SHEET 2 OF 2

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	PER ECN 3651 ADDED VIEW A-A	1-18-83	WBell
	B	PER ECN 5180 ADD -002 DN	2-28-84	C Lee





VIEW A-A

NO SCALE

MULTIUSAGE

		1656972						UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 ANGLES 0° 30' HOLE TOLERANCES	ENGINEERING ACTIVITY ECN M 2984 L-3	DELTA DESIGN INC. A SUBSIDIARY OF CONNU INC. SAN DIEGO, CA. 92123
		MULTIUSAGE							DESIGN	TITLE: RELAY ASSY, SOLID STATE
001	1	1648289							DRAFTED ALEXANDER 9/21/82	
001	1	1641192							CHECKED	
001	1	1650477							APPROV C Lee 3/1/84	SIZE B / CODE IDENT / 1654248 / REV. B
001	1	1650160							RELEASE	
DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV	MATERIAL			
APPLICATION				EFFECTIVITY			FINISH		DO NOT SCALE DWG	SCALE FULL / SHEET 1 OF 1

⚠1 THOUGHLY COAT BOTTOM OF RELAY WITH THERMAL COMPOUND TO CREATE A GOOD HEAT CONDUCTIVITY WITH HEAT SINK.

NOTES: UNLESS OTHERWISE SPECIFIED

PL 1654248 REV B SHT 1 OF 1

DESCRIPTION RELAY ASSY, SOLID STATE

NEXT ASSY MULTIUSAGE BY RA CK'D ____ APPD C Lee

REV	ECN	DATE	BY	APP
A/C	2289	9-7-2		
A	3661	2-16	Hanna	
B	5180	2-28-84	DAI	

DELTA DESIGN
5725 KEARNY VILLA RD.
SAN DIEGO, CALIF.

JOB NO. ____ S.O. NO. ____
QTY ____ PROM DATE ____ ACT ____
RUN * ____ MACH ____

ITEM NO	ASSY & QTY -001	-002	-003	-004	INDENTURE	SIZE	DRAWING NO.	REV	DESCRIPTION	MFG OR MFG NO.	STOCK OR PART NO.	JOB QTY	AUL	QTY REC	FAB CD	PURCHASING P.O. NO.	QTY	DUE	REC	MANUFACTURE ACT STD HRS	EST ACT COM	COM	PLATE/PAINT IN	OUT	AREA
00	X					B	1654248		RELAY ASSY, SOLID STATE		1654248-001														
00		X				B	1654248		RELAY ASSY, SOLID STATE		1654248-002														
00																									
00																									
00																									
00																									
00																									
01	1	1				B	1654184		HEATSINK, SOLID STATE RELAY		1654184-101														
02																									
03	1	2							RELAY, SOLID STATE	CRYDOM D2425	1400194														
04	2	4							SCREW 8-32 x .375 SHC-MS		6808323-808														
05	2	4							WASHER, SPLIT #8		6608010														
06	A/R	A/R							THERMAL COMPOUND		9900026														
07																									

NOTES:

1654248 P/L REV B

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